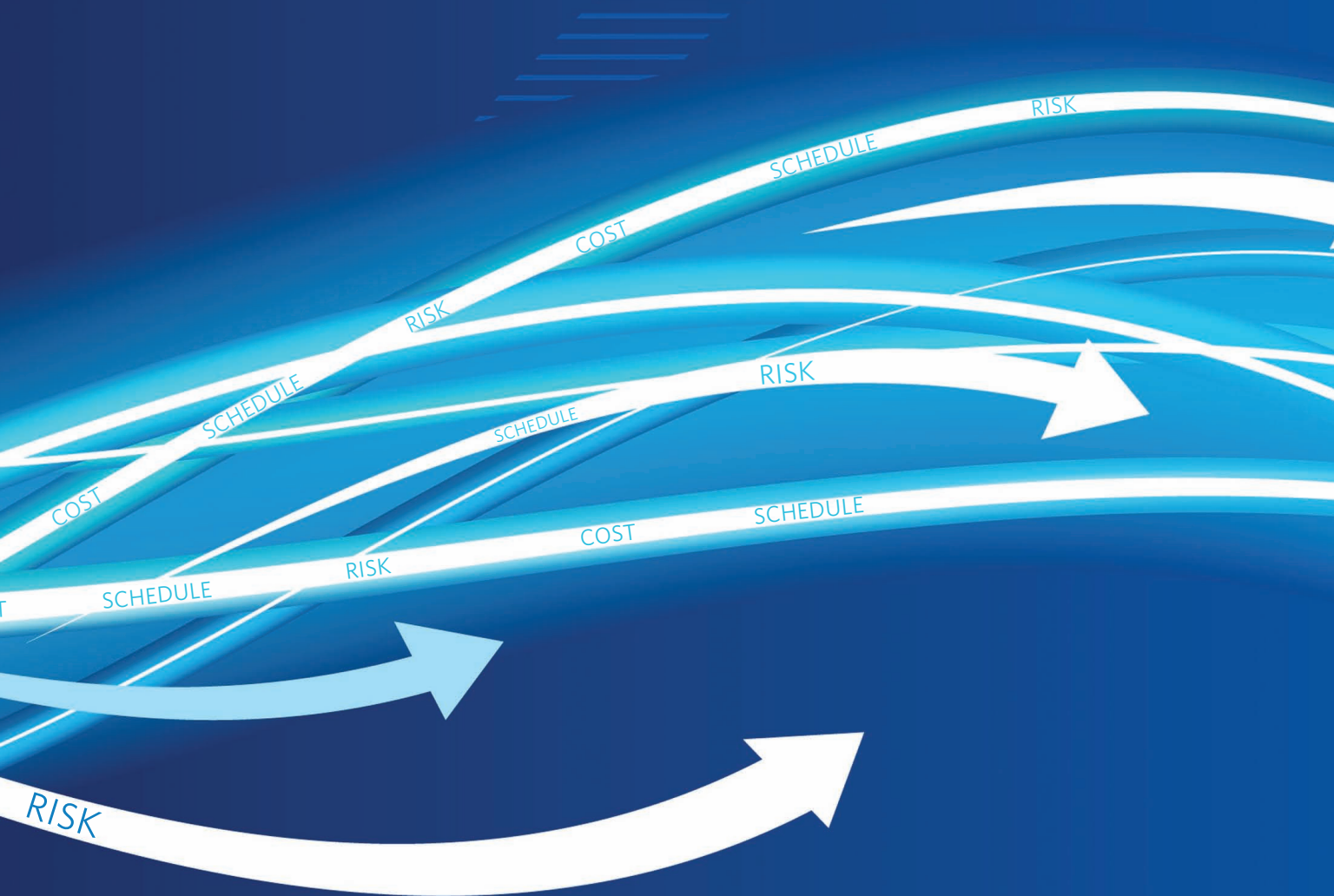# WSARA One Year Later

William R. Fast

I f the Weapon System Acquisition Reform Act of 2009 (WSARA, enacted May 22, 2009) is to have any lasting effect, the behaviors of the defense acquisition workforce must change. One of my major concerns is how we can better train our major defense acquisition program (MDAP) managers and support staffs in the practical application of the tenets or principles of WSARA, most of which are really not new; they just mean getting back to the basics of acquisition! This article addresses three key challenges of WSARA and outlines some actions we need to take to change the culture of our acquisition workers.

Integrated Cost and Schedule Estimation

First, we need to adopt an integrated team approach to cost and schedule estimation. For too long, we have left cost estimation to the cost estimators. To further aggravate the situation, we outsourced many of our government cost estimators in the 1990s and are paying the price today. In the past, we have expected the cost estimators alone to do the business of cost estimation, yet we never told them all they needed to know in order to prepare a realistic cost estimate.

Then once we got their cost estimate, we pressed them to reduce the estimate to a more "affordable" number. We also hoped for new manufacturing processes and economies of scale that might keep the program affordable

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(for example, the Joint Strike Fighter). Sometimes, we even threw out the cost estimate altogether and simply funded to available budget. Such was the case with the Army's Future Combat System when it entered development at Milestone B in 2003. Not a good way to start a program! According to Gene Porter in a December 2009 Institute for Defense Analyses paper entitled "The Major Causes of Cost Growth in Defense Acquisition," when that occurs, the entire decision-making process is put at risk, including both the original analysis of alternatives and the subsequent stability and executability of the program.

Cost and schedule estimation is a craft—a craft that requires reasoned inputs from systems engineers, logisticians, contracting officers, and testers, in addition to those of experienced cost estimators. It requires an integrated team of functional experts dedicated to identifying risk and assigning cost and schedule to that risk. Cost and schedule estimates cannot be done in a vacuum by a single estimator. It's a team sport in which multi-functional inputs are essential for success.

WSARA created the position of director of cost assessment and program evaluation in 2009. In addition to reviewing all component cost estimates and conducting an independent cost estimate for MDAPs, the director of cost assessment and program evaluation is to provide policies and procedures for all DoD cost estimates. That's a tall order, and one that can be achieved only if the grassroots acquisition workers make integrated cost and schedule estimation part of their day-to-day routine. That's because no policy or procedure can ever be written that will turn over all the technical and programmatic "rocks" under which cost and schedule risks lie in waiting. Our systems are just too complex. And even if it could be written, no policy or procedure has ever seen 100 percent compliance.

If the Weapon System Acquisition Reform Act of 2009 is to have any lasting effect, the behaviors of the defense acquisition workforce must change.

WSARA also requires the disclosure of the confidence levels for baseline estimates for MDAPs. Justification must be provided if the cost estimate is calculated at a confidence level less than 80 percent. Now, the law doesn't specify how confidence levels are calculated or explain why 80 percent is the target, as opposed to 90 percent or 70 percent. The intent of the law is to hedge against cost overruns.

Wouldn't we serve the same purpose if we used integrated cost and schedule estimation to uncover technical and programmatic risks and covered those risks at the beginning of the program to create more realistic cost and schedule estimates? Wouldn't risk-informed cost and schedule estimates be more easily defended through the budgeting process and to Congress?

The solution, from where I sit, is to teach and model integrated cost and schedule estimating to the grassroots acquisition workers. We have totally revamped our training for cost estimators and put them into their own career track, and we must not stop integrating cost and schedule estimation in our other acquisition courses. In addition, risk identification and management should become part of the curriculum so the acquisition worker can discover technical and programmatic risks and adjust cost and schedule estimates to mitigate them. I'll come back to that point later.

Competitive Prototyping

Let's talk about the "art" of competitive prototyping. I call prototyping an art because it is part of a program's acquisition strategy. From my experience, acquisition strategy development is more of an art than a prescriptive science. I also know from teaching in the DAU PMT 352 program management office course that competitive prototyping is not well understood. In that course, students have to lay out a strategy for competitive prototyping prior to Milestone B. My experience is that we get all kinds of approaches, many of which reveal that students don't understand exactly what a developmental prototype is and how competitive prototyping might be used in the technology development phase prior to Milestone B.

For MDAPs, WSARA mandated competitive prototyping of systems or critical subsystems before Milestone B approval, unless waived by the milestone decision authority. Moreover, even if competitive prototyping is waived, a prototype must be produced before Milestone B.

Competitive prototyping isn't new to the Department of Defense. Even before WSARA, John Young, then-under secretary of defense for acquisition, technology and logistics, made it policy to have multiple competitive prototypes in order to determine the maturity of the technology and get a better cost estimate prior to Milestone B. Today, the Joint Air-Ground Missile, Joint Lightweight Tactical Vehicle, and Small Diameter Bomb II are examples of programs that seem to be using competitive prototyping with some success.

Yet there are also the failures—not failures in the sense of program failure, but failures in the sense that competitive prototyping really does not appear to have been cost-effective. Porter argues that the cost of developmental prototypes for the Joint Strike Fighter and Littoral Combat Ship only added to cost growth and may not have been worth the effort.

The concept of competitive prototyping is, indeed, new to many of today's acquisition workers because its use has been cyclical. The idea of prototyping aircraft engine and airframe combinations can be traced back some 20 years before World War II and was fairly common into the 1950s. A "fly-before-buy" strategy was instituted in the late 1960s by David Packard, then-deputy secretary of defense, but it fell out of favor by the late 1970s. Once again, the 1986 Packard Commission Report emphasized prototyping before full-scale development and this became part of DoD Instruction 5000.2 in 1987. However, both Porter and Jeffrey A. Drezner, author of a 1992 Rand Corporation research report, "The Nature and Role of Prototyping in Weapon System Development," point out that the nature of prototyping, the conditions under which one should prototype, and the benefits of prototyping remain unidentified.

Today's acquisition workers need to rethink and relearn competitive prototyping. They need to be trained on how to make a sound business case for competitive prototyping—if one actually exists. They need to think through how they will manage two or more contractors in a competition-sensitive environment. And—back to the cost estimating that I discussed earlier—they need to know how to convince decision makers in the programming and budgeting processes that

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the additional cost of multiple prototypes is worth the funding. In addition, they need to understand advanced technology demonstrations and joint capability technology demonstrations that have long been in the domain of the science and technology community but should now be considered as viable prototyping approaches in the technology development phase.

Even more difficult for acquisition students to understand is how to compete at the critical subsystem level, as is permitted by WSARA. Full-up system prototypes are clearly impractical for big developments such as aircraft carriers and for one-of-a-kind satellites. Acquisition workers not only need to understand how to down-select from competing subsystem-level prototypes, but they also need to understand the on-ramp processes by which these winning components are integrated back into the larger system.

I advocate that case studies, written around programs that have used competitive prototypes (whether successful or unsuccessful) be injected into DAU program management certification courses. In addition, the PMT 352 program management office course should include a seminar on competitive prototyping just prior to the exercise in which students develop an acquisition strategy around competitive prototyping.

Systems Engineering Decisions

Now let me turn to the third challenge of asking the right questions and making the tough systems engineering decisions, especially during preliminary and critical design reviews. As a quick review, the preliminary design review defines the allocated baseline for the weapon system, and according to WSARA, the preliminary design review (PDR) for MDAPs must come before the Milestone B decision review. Similarly, the critical design review defines the product baseline for the system and now separates the two major efforts of the engineering and manufacturing development phase: (1) integrated system design; and (2) systems capability and manufacturing process demonstration. Prior to WSARA, DoD Instruction 5000.02 raised the importance of these reviews by requiring post-PDR and post-critical design review assessments by the milestone decision authority, with decisions from those assessments documented in acquisition decision memoranda.

During the technology development phase, WSARA and DoD Instruction 5000.02 require that MDAPs conduct a system-level PDR: "A successful PDR will inform requirements trades; improve cost estimation; and identifies remaining design, integration, and manufacturing risks." The cost-performance trades that result from knowledge gained during competitive prototyping can help keep the program affordable and within the Milestone A component cost estimate. But are we teaching our acquisition workers what questions to ask at the PDR about design, integration and manufacturing risks? More important, are we really training them to make the tough decisions regarding cost and performance trades?

According to DoD Instruction 5000.02, "The project shall exit the technology development phase when an affordable program or increment of militarily useful capability has been identified; the technology and manufacturing processes for that program or increment have been assessed and demonstrated in a relevant environment; manufacturing risks have been identified; a system or increment can be developed for production in a short timeframe (normally less than five years for weapon systems); or, when the MDA decides to terminate the effort." That's a lot to ask! Are we really training the people who staff our pre-MDAP program offices to make those assessments and recommendations?

Too often in the past, programs have entered the engineering and manufacturing development phase without having demonstrated required technologies in a relevant environment, which is defined as technology readiness level (TRL) 6. In last year's class of Nunn-McCurdy-breaching programs, root cause analyses identified several bad actors. Porter reports that when the Army's Future Combat System entered system development and demonstration in 2003, 24 out of 31 of the identified critical technologies were at TRLs below 6. None of the 20 critical technologies was at TRL 6 when the Joint Tactical Radio Systems–Ground Mobile Radio entered system development and demonstration in 2002. The War-fighter Information Network–Tactical had only three of 12 critical technologies at TRL 6 when it entered systems development and demonstration in 2003 (Porter, p. 44).

WSARA now requires the director of defense research and engineering to conduct an independent assessment of the technological maturity and integration risk of the critical technologies of MDAPs. In addition, the DDRE is to develop knowledge-based standards to measure the technological maturity and integration risk of critical technologies at key stages in the acquisition process. In the past, the program manager was responsible for technology readiness assessments that were based upon definitions provided in the *Defense Acquisition Guidebook*.

Inadequacies in initial system design, systems engineering, and risk assessment at the front end of the program continue to translate into poor cost and schedule estimates (Porter, p. 45-46). We continue to shortchange early system engineering efforts in that critical timeframe between identification of the capability gap and Milestone B. In past acquisition workforce downsizing efforts, we got rid of key government engineers who shepherded the transition of new technologies into acquisition programs, so now we have lost their knowledge of how to assess technology readiness and manage technology transition risks.

We also do a poor job of estimating systemic risks inherent in the total system design. As we link systems to other systems, government program management office personnel need to better understand the integration and interoperability challenges. Case in point: We don't again want to get into a posi-

tion where we have to hire a lead systems integrator, as was the case with the Army's Future Combat System.

We need to teach our acquisition workers how early systems engineering design reviews can identify risks. We need to help them understand the risks associated with the integration of systems of systems. We need to lead them through case studies that demonstrate the value of early systems engineering and teach them some of the basic questions that need to be asked. We also need to train our people in the early decisions that must be made regarding which technologies are ready for the first increment of development and which technologies need to be deferred to later increments of capability.

We need to emphasize early systems engineering in our on-line fundamental and intermediate systems acquisition management courses. We also need to integrate more risk management training in *all* our acquisition courses. Currently, risk management is taught only as a targeted training event at the request of a program office or acquisition command. Much can be done to make our risk instruction more robust and to link it more clearly to early systems engineering.

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Arnie, whose program held the 2010 record for cost overruns, is inducted into the Acquisition Hall of Shame.

Institutionalizing WSARA

What will it take to really institutionalize WSARA? I feel strongly that changing the culture of the acquisition workforce requires that we change the way we teach and model the acquisition process. I've discussed three acquisition challenges to begin with as we seek to change behaviors and get back to basics. First, we need an integrated team approach to estimating cost and schedule. Cost and schedule estimation are not the responsibility of the cost estimator alone. Second,

we must teach the art of competitive prototyping; we must rethink and relearn from the past and define the nature of prototyping, under what conditions one should prototype, and the benefits of prototyping. And third, we must help our acquisition workers ask the right questions and make the tough systems engineering decisions, especially during preliminary and critical design reviews. Those actions will go a long way in helping us understand programmatic and technical risks earlier.

Fast teaches acquisition and program management courses at the Naval Postgraduate School. Prior to that, he taught in the program management office course at DAU. The author welcomes comments and questions and can be contacted at **wrfast@nps.edu.**